



US005564116A

**United States Patent [19]**

Arai et al.

[11] Patent Number: 5,564,116

[45] Date of Patent: Oct. 8, 1996

IDS

## [54] ARRAY TYPE STORAGE UNIT SYSTEM

[75] Inventors: Kouji Arai, Odawara; Takao Satoh; Akira Yamamoto, both of Sagamihara, all of Japan

[73] Assignee: Hitachi, Ltd., Tokyo, Japan

[21] Appl. No.: 341,082

[22] Filed: Nov. 17, 1994

## [30] Foreign Application Priority Data

Nov. 19, 1993 [JP] Japan ..... 5-290538

[51] Int. Cl.<sup>6</sup> ..... G06F 11/00

[52] U.S. Cl. ..... 395/182.05; 395/441

[58] Field of Search ..... 395/575, 425, 395/182.04, 182.05, 441; 371/10.1, 40.4, 51.1

## [56] References Cited

## U.S. PATENT DOCUMENTS

5,237,658	8/1993	Walker et al.	.....	395/575
5,331,646	7/1994	Krueger et al.	.....	371/40.4
5,337,322	8/1994	Wang et al.	.....	371/51.1
5,357,509	10/1994	Ohizumi	.....	371/10.1
5,390,187	2/1995	Stallmo	.....	371/10.1
5,390,327	2/1995	Lubbers et al.	.....	371/40.1

## OTHER PUBLICATIONS

Menon et al, "Methods for Improved Update Performance of Disk Arrays", IEEE, System Sciences, 1992, Ann. Hawaii Int'l Conf. pp. 74-83.

Reddy et al, "Gracefully Degradable Disk Arrays", IEEE, Fault-Tolerant Computing, 1991, Int'l Symposium pp. 401-408.

D. Patterson et al, "A Case for Redundant Arrays of Inexpensive Disks (RAID)", ACM SIGMOD Conference Proceedings, 1988, pp. 109-116.

Primary Examiner—Robert W. Beausoliel, Jr.

Assistant Examiner—Joseph E. Palys

Attorney, Agent, or Firm—Fay, Sharpe, Beall, Fagan, Minich & McKee

## [57] ABSTRACT

A storage unit system includes a control apparatus having a unit for reading memory data from a plurality of storage units before increase into a memory of the control apparatus, a preparing unit for preparing parity data newly from the memory data read in the memory, a rearrangement unit for dispersing transfer data from a processor read in the memory and the newly prepared parity data to be written into a plurality of storage units after the increase to perform arrangement of data, a memory unit for storing a write position on the way of the rearrangement of data, a comparison unit for comparing an access position for an access request from the processor with the write position, and a determining unit for determining a data dispersed pattern used in a data access from the processor on the basis of a comparison result of the comparison unit, whereby the storage unit can be increased individually with a unit of one storage unit and dynamically without stop of the system.

6 Claims, 6 Drawing Sheets

